National Aeronautics and Space Administration

technology opportunity

Non-Chromate Conversion Coatings for Aluminum Alloys and Ferrous Metals

Treating surfaces with safe, low-cost processes

Innovators at NASA's Glenn Research Center have developed non-chromate conversion coating processes for both aluminum alloys and ferrous metals. The coatings enhance adhesion and corrosion resistance and use materials that are low cost and require no specialized or expensive equipment. The U.S. Environmental Protection Agency encourages the phase-out of surface pretreatment processes based on chromates because of their toxicity and the costs associated with by-product cleanup. These two safe and environmentally friendly non-chromate conversion processes perform well on materials in a wide variety of industries.

Benefits

- **Safe:** Uses no chromate materials and generates no toxic by-products
- **Affordable:** Saves costs by using inexpensive materials
- **Efficient:** Completes processing in less time and cost than conventional methods

Applications

- Automotive industry (alloy wheels and other aluminum alloy components)
- Construction industry (metals used in steel structures, aluminum doors, and window frames)
- Aerospace industry (aluminum aircraft components)
- Sporting goods (baseball bats and bicycle structures)
- Extrusion and die cast equipment
- Metal screws and nuts

Technology Details

Conversion coatings are applied to aluminum and ferrous metal surfaces to prepare for the application of paint and to protect against corrosion. Often, these conversion coatings contain hexavalent chromium, a known carcinogen when inhaled. Glenn researchers have developed two processes that do not include hexavalent chrome-based coatings.

How It Works

For aluminum alloys: The conversion process is essentially a drip process. A pre-cleaned aluminum alloy substrate is immersed in an aqueous solution at room temperature for 2 minutes. The aqueous solution consists of 3 low-cost chemicals present in small concentrations. The aluminum alloy substrate is then withdrawn from the solution, rinsed with water, and allowed to dry. At Glenn, the coatings are characterized by x-ray photoelectron spectroscopy and Fourier transform infrared microscopy techniques.

For ferrous metals: A vapor deposition procedure is the focus of the conversion process for ferrous metals, such as low carbon steels. A small amount of an organic liquid solution is injected into a heated (275°C) oven that contains the ferrous metal substrate. The organic liquid vaporizes and the vapor reacts with the metal surface, producing a coating. Different coatings can be deposited on the ferrous metal surface depending on the precursor materials.

Why It Is Better

One of the most historically pervasive uses of chromate is its use as a coating agent. Environmental safety and health risks associated with hexavalent chromium have led the EPA to regulate its use, and a significant push exists to find new, alternative conversion coatings. There is a clear need for new advances in coating technology that could provide practical options for replacing present industrial practices. These two processes have been tested at Glenn and enhance both adhesion and corrosion resistance in a cost-effective manner.

Licensing and Partnering Opportunities

Glenn's Technology Transfer and Partnership office seeks to transfer technology into and out of NASA to benefit the space program and U.S. industry. NASA invites companies to discuss partnership opportunities involving this innovative coating technology (LEW-17245-1) for commercial applications.

For More Information

For more information about this and other technology licensing opportunities, please visit:

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